LXXIV. *A ſhort Diſſertation on Maps and Charts: In a Letter to the Rev.* Thomas Birch, *D. D. and Secret. R. S. By Mr.* Wm. Mountaine, *F. R. S.*

S I R, London, March 21. 1758.

Read April 6. 1758.

AMONG the ſeveral improvements made in arts and ſciences by ingenious men, the conſtruction of *globes*, *maps*, or *charts*, deſerves a place: not only on account of the pleaſure and ſatisfaction that ariſes to ſpeculative minds, in ſurveying the extent and diviſions of this terraqueous globe, but alſo for their real uſe and ſervice to navigation, trade, and commerce.

Globes perhaps were firſt invented, as bearing the neareſt ſemblance to the natural form of the earth and ſea, with proper circles thereon deſcribed, and the ſeveral empires and kingdoms, according to their extent, latitudes, and longitudes, as far as geography and hiſtory would admit.

But tho' theſe convey the moſt general and trueſt ideas of the poſition and ſituation of places; yet, as containing but a ſmall ſurface, they were found not extenſive enough to take in particular kingdoms or ſtates, with their ſubdiviſions, cities, and rivers, ſo as to convey an adequate and ſufficient repreſentation. Beſides, they were not ſo portable and commodious in voyages or travels.

Maps and *Charts* were therefore thought of, as being moſt convenient for both the purpoſes above-

mentioned;

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mentioned; the accuracy of which depends on repreſenting the meridians and parallels in ſuch manner, that when places are laid thereon, according to their latitudes and longitudes, they may have ſuch reſpect to each other, as they have on the globe itſelf; and thoſe are either *globular* or *rectilinear.*

Globular, or *curvilinear*, are either general or particular.

General, are the hemiſpheres; for the moſt part conſtructed ſtereographically.

Particular, contain only ſome part of the terraqueous globe; and of this ſort there are ſundry modes of conſtruction, which for the moſt part are defective, ſo as not to be applied with accuracy and facility to the purpoſes intended, in determining the courſes or bearings of places, their diſtances, or both.

Rectilinear were therefore very early adopted, on which the meridians were deſcribed parallel to each other, and the degrees of latitude and longitude everywhere equal; the rumbs were conſequently right lines; and hereby it was thought, that the courſes or bearings of places would be more eaſily determined.

But theſe were found alſo inſufficient and erroneous, the meridians being parallel, which ought to converge; and no method or device uſed to accommodate that paralleliſm.

Notwithſtanding the great deficiency in this plane map or chart, it was preferred, eſpecially in nautical buſineſs; and hath its uſes at this day in topographic conſtructions, as in bays, harbours, and very narrow zones.

However, the errors herein were ſooner diſcovered than corrected, both by mathematicians and mariners, as by Martin Corteſe, Petrus Nonius, Coigniet, and ſome ſay by Ptolemy himſelf.

The firſt ſtep towards the improvement of this chart was made by Gerardus Mercator, who publiſhed a map about the year 1550, wherein the degrees of latitude were increaſed from the equator towards each pole; but upon what principles this was conſtructed, he did not exhibit.

About the year 1590, Mr. Edward Wright, an Engliſhman, diſcovered the true principles upon which ſuch a chart ſhould be conſtructed; and communicated the ſame to one Jodocus Hondius, an engraver, who, contrary to his honeſt faith and engagement, publiſhed the ſame as his own invention: This occaſioned Mr. Wright, in the year 1599, to exhibit his method of conſtruction, in his book, intitled, *Correction of Errors in Navigation*; in the preface of which book may be ſeen his charge and proof againſt Hondius; and alſo how far Mercator has any right to ſhare in the honour due for this great improvement in geography and navigation.

Blundevill, in his Exerciſes, page 327, publiſhed anno 1594, gives a table of meridional parts anſwering to even degrees, from 1° to 80° of latitude, with the ſketch of a chart conſtructed therefrom; but this table he acknowledgeth to have received from Mr. Wright, in the following words, page 326, *viz.* " In the mean time to reform the ſaide faults," (in the plane chart) " Mercator hath in his univerſal
" chard or mappe made the ſpaces of the parallels
" of latitude to bee wider everie one than other
" from the equinoctial towards either of the poles,

" by what rule I know not, unleſs it be by ſuch a
" table as my friend Maiſter Wright of Caius-col-
" lege in Cambridge at my requeſt ſent me (I thank
" him) not long ſince for that purpoſe, which table
" with his conſent, I have plainlie ſet down," *&c.*

About the year 1720, a globular chart was publiſhed, ſaid to be conſtructed by Mr. Henry Wilſon; the errors in which were obviated by Mr. Thomas Haſelden, in a letter to Dr. Halley; who at the ſame time exhibited a new ſcale, whereby diſtances on a given courſe may be meaſured, or laid off, at one extent of the compaſſes, on Wright's projection; and was intended to render the ſame as eaſy in practice as the plane chart.

The above chart was publiſhed in oppoſition to Mr. Wright's, which that author charged with imperfections and errors, and that it repreſented places bigger than they are upon the globe.

It is true, the ſurface is apparently enlarged; but the poſition of places, in reſpect to one another, are in no wiſe diſtorted; and it may be aſſerted, with the ſame parity of reaſon, that the lines of ſines, tangents, and ſecants, are falſe, becauſe the degrees of the circle, which are equal among themſelves, are thereupon repreſented unequal.

Yet if a map or chart was ſo conſtructed, as to ſhew the ſituation and true extent of countries, *&c.* *primâ facie* (if I may be allowed the expreſſion), and yet retain all the properties, uſes, and ſimplicity, of Wright's conſtruction, it would be a truly great improvement; but this ſeems to be impoſſible.

The method exhibited by the Rev. Mr. Murdoch, in his paper, read before the Royal Society on the 9th of February laſt, ſhews the ſituation of places, and

and ſeems better calculated for determining ſuperficial and linear meaſures, than any other that has occurred to me.

This Gentleman illuſtrates his theory with examples juſtly intended to point out the quantity of error, that will happen in a large extent.

For inſtance; Between latitudes 10° and 60° N. and containing 110 degrees difference of longitude, Mr. Murdoch computes the diſtance at 5594 miles; which, upon the arc of a great circle, is found to be 5477, or by other methods 5462; ſo that the difference is only 117, or at moſt 132 miles in ſo great an extent, and to an high latitude; and the higher the latitude the greater the error is like to be, whereever middle latitude is concerned.

His courſes alſo agree very nearly with computations made from the tables of meridional parts.

In example the firſt they are the very ſame:

In example the 2d they agree to half a minute:

In example the 3d they vary 1° 4′, on account of the high latitudes, which extend from 56° to 80°N.

However, I do not eſteem this method ſo ſimple, eaſy, and conciſe, in the practice of navigation, as Mr. Wright's conſtruction, eſpecially in determining the bearings or courſes from place to place: nor will it (I preſume) admit of a zone containing both north and ſouth latitude.

Of theſe inconveniences Mr. Murdoch ſeems to be extremely well acquainted, when he expreſſes himſelf in the following very candid and ingenuous terms, *viz.* " As to Wright's or Mercator's nauti-
" cal chart, it does not here fall under our conſide-
" ration: it is perfect in its kind; and will always
" be reckoned among the chief inventions of the
" laſt

“ laſt age. If it has been miſunderſtood or miſap- “ plied by geographers, they only are to blame.”— And again, at the end of his nautical examples, he concludes thus, *viz.* “ It is not meant, however, “ that it ought to take place of the eaſier and “ better computation by a table of meridional “ parts.”

I have the honour to be, with the greateſt reſpect,

SIR,

The ROYAL SOCIETY's, and

Your moſt obedient Servant,

William Mountaine.

ADDENDA *to Mr.* Murdoch's *Paper*, N°. LXXIII.

IF it is required “ to draw a map, in which the ſuperficies of a “ given zone ſhall be equal to the zone on the ſphere, while “ at the ſame time the projection from the center is ſtrictly geometrical;” *Take* Cx *to* CM *as a geometrical mean between* CM *and* Nn, *is to the like mean between the coſine of the middle latitude, and twice the tangent of the ſemidifference of latitudes*; and project on the conic ſurface generated by xt. But here the degrees of latitude towards the middle will fall ſhort of their juſt quantity, and at the extremities exceed it: which hurts the eye. Artiſts may uſe either rule: or, in moſt caſes, they need only make Cx to CM as the arc ML is to its tangent, and finiſh the map; either by a projection, or, as in the firſt method, by dividing that part of xt which is intercepted by the ſecants thro' L and l, into equal degrees of latitude.

Mr. Mountaine juſtly obſerves, “ that my rule does not admit of “ a zone containing N. and S. latitudes.” But the remedy is, *to extend the leſſer latitudes to an equality with the greater; that the cone may be changed into a cylinder, and the rumbs into ſtraight lines.*

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